

CLAIMS

What is claimed is:

- 5 1. In an apparatus including a stepper motor as an actuator of a moveable element against a variable load, a method for increasing the torque output of the stepper motor to overcome a load exceeding the nominal torque output capability of the stepper motor, comprising the steps of:
 - a) sensing when a high load condition exists; and
 - 10 b) increasing voltage provided to the stepper motor to increase the torque output thereof when said high load condition exists.
2. A method in accordance with Claim 1 wherein said apparatus is a fuel cell assembly.
- 15 3. A method in accordance with Claim 2 wherein the stepper motor is an actuator for an air valve in said fuel cell assembly and said moveable element is a pintle thereof.
- 20 4. A method in accordance with Claim 2 wherein said voltage increase is obtained from the electrical output of said fuel cell assembly.
5. A method in accordance with Claim 2 wherein said fuel cell assembly is selected from the group consisting of solid-oxide fuel cell assembly
25 and proton exchange membrane fuel cell assembly.
6. A method in accordance with Claim 1 wherein a time period of said increased voltage is less than about five seconds.
- 30 7. In an apparatus including a stepper motor for actuating a moveable element, the stepper motor having a nominal torque output range at a

nominal input voltage, the improvement for extending the torque output range of the motor comprising:

- a) means for determining an actuating load on said motor;
- b) means for providing a voltage input to said motor greater than said
5 nominal input voltage;
- c) control means connected to said determining means and said providing means for responding when said actuating load exceeds a predetermined load value and to increase said voltage applied to said motor above said nominal voltage and thereby to increase the torque output of said motor to move said
10 moveable element.

8. An apparatus in accordance with Claim 7 wherein said apparatus is a fuel cell assembly including at least one pintle-type valve and said moveable element is a pintle thereof.

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9. An apparatus in accordance with Claim 8 wherein said fuel cell assembly is selected from the group consisting of solid-oxide fuel cell assembly and proton exchange membrane fuel cell assembly.

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10. An apparatus in accordance with Claim 8 wherein said valve is an air valve in said fuel cell assembly and wherein said stepper motor is an actuator for said air valve.

11. An apparatus in accordance with Claim 8 wherein said fuel cell
25 assembly is included in an auxiliary power unit for a vehicle.